Icarus

INTERNATIONAL JOURNAL OF SOLAR SYSTEM STUDIES

Volume 35 • 1978

EDITOR: *Carl Sagan*

Laboratory for Planetary Studies
Cornell University
Ithaca, New York 14853

ACADEMIC PRESS
New York and London

A Subsidiary of Harcourt Brace Jovanovich, Publishers

Copyright © 1978 by Academic Press, Inc.

ALL RIGHTS RESERVED

No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopy, recording, or any information storage and retrieval system, without permission in writing from the copyright owner.

The appearance of the code at the bottom of the first page of an article in this journal indicates the copyright owner's consent that copies of the article may be made for personal or internal use, or for the personal or internal use of specific clients. This consent is given on the condition, however, that the copier pay the stated per copy fee through the Copyright Clearance Center, Inc. (Operations Staff, P.O. Box 765, Schenectady, New York 12301), for copying beyond that permitted by Sections 107 or 108 of the U.S. Copyright Law. This consent does not extend to other kinds of copying, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale. Copy fees for pre-1978 articles are the same as those shown for current articles.

CONTENTS OF VOLUME 35

Number 1, July 1978

ICHARD GREENBERG, JOHN F. WACKER, WILLIAM K. HARTMANN, AND CLARK R. CHAPMAN. Planetesimals to Planets: Numerical Simulation of Collisional Evolution 1

NDREW P. INGERSOLL AND CAROLYN C. PORCO. Solar Heating and Internal Heat Flow on Jupiter 27

. J. KLEIN AND S. GULKIS. Jupiter's Atmosphere: Observations and Interpretation of the Microwave Spectrum Near 1.25-cm Wavelength 44

. F. ERICKSON, D. GOORVITCH, J. P. SIMPSON, AND D. W. STRECKER. Far Infrared Spectrophotometry of Jupiter and Saturn 61

FURNISS, R. E. JENNINGS, AND K. J. KING. Observations of the Far Infrared Spectrum of Jupiter 74

. W. LOCKWOOD. Analysis of Photometric Variations of Uranus and Neptune Since 1953 79

IICHAEL J. PRICE. Limb Brightening on Uranus: An Interpretation of the λ7300 Å Methane Band 93

. J. WEIDENSCHILLING. Iron/Silicate Fractionation and the Origin of Mercury ... 99

UCY L. DANYLEWYCH, RALPH W. NICHOLLS, JOHN S. NEFF, AND JEREMY B. TATUM. Absolute Spectrophotometry of Comets 1973 XII and 1975 IX. II. Profiles of the Swan Bands 112

JARNE S. HAUGSTAD. Turbulence in Planetary Occultations. I. A Theoretical Formulation 121

HARLES N. ADAMS AND GEORGE W. KATTAWAR. Radiative Transfer in Spherical Shell Atmospheres. I. Rayleigh Scattering 139

VM. HAYDEN SMITH AND DALE P. CRUIKSHANK. Search for HD in Jupiter and Saturn 152

AMES L. ELLIOT. Direct Imaging of Extra-solar Planets with Stationary Occultations Viewed by a Space Telescope 156

NNOUNCEMENT 165

Number 2, August 1978

. HOLLINGSWORTH SMITH. Diameters of the Galilean Satellites from Pioneer Data 167

V. B. HUBBARD. Comparative Thermal Evolution of Uranus and Neptune 177

DAVID CRISP AND ANDREW T. YOUNG. Vertical Extent of Zonal Winds on Venus .. 182

ROBERT A. BROWN AND RICHARD M. GOODY. The Persistence and Size of Thermal Anomalies on Venus 189

RICHARD W. ZUREK. Solar Heating of the Martian Dusty Atmosphere 196

V. G. EGAN, T. HILGEMAN, AND L. L. SMITH. Comparison Between Infrared Martian Disk Spectra and Optical Properties of Terrestrial Analogs 209

. J. MELOSH AND D. DZURISIN. Mercurian Global Tectonics: A Consequence of Tidal Despinning? 227

. L. ELLIOT, E. W. DUNHAM, J. VEVERKA, AND J. GOGUEN. Lunar Occultation of Saturn. II. The Normal Reflectances of Rhea, Titan, and Iapetus 237

Robert G. Danehy, Tobias Owen, Barry L. Lutz, and Jerry H. Woodman. Detection of the Kuiper Bands in the Spectrum of Titan 247
M. D. A. Rosen and F. M. Pipkin. Reflectance Spectra for Sodium and Potassium Doped Ammonia Frosts: Implications for Io's Surface 252
James C. Kemp, Richard J. Rudy, Marcia J. Lebofsky, and George H. Rieke. Near-Infrared Polarization Studies of Saturn and Jupiter 263
John A. O'Keefe and Edward C. Sullivan. Fission Origin of the Moon: Cause and Timing 272

Book Reviews

Audouin Dollfus. *Flight to Mercury*, Bruce C. Murray and Eric Burgess 284
Richard Greenberg. *Interplanetary Encounters: Close Range Gravitational Interactions*, E. J. Öpik 284
Announcements 287

Number 3, September 1978

M. W. Werner, G. Neugebauer, J. R. Houck, and M. G. Hauser. One-Millimeter Brightness Temperatures of the Planets 289
G. S. Orton and R. J. Terrile. Multiple Frequency Sounding of a Jovian Cloud. 297
John Caldwell, F. C. Gillett, I. G. Nolt, and A. Tokunaga. Spatially Resolved Infrared Observations of Saturn. 1. Equatorial Limb Scans at 20 μm 308
Edward Bowell, Clark R. Chapman, Jonathan C. Gradie, David Morrison, and Benjamin Zellner. Taxonomy of Asteroids 313
Larry A. Lebofsky, Glenn J. Veeder, Marcia J. Lebofsky, and Dennis L. Matson. Visual and Radiometric Photometry of 1580 Betulia 336
E. Tedesco, J. Drummond, M. Candy, P. Birch, I. Nikoloff, and B. Zellner. 1580 Betulia: An Unusual Asteroid with an Extraordinary Lightcurve 344
Ray L. Newburn, Jr. and Torrence V. Johnson. Postperihelion Interference Filter Photometry of the "Annual" Comet P/Encke 360
O. Ashihara. Photoelectron Fluxes in Cometary Atmospheres 369
Arthur S. Trevena and M. Dane Picard. Morphometric Comparison of Braided Martian Channels and Some Braided Terrestrial Features 385
W. Liller, C. Papaliolios, R. G. French, J. L. Elliot, and C. Church. The Occultation of ϵ Gem by Mars as Observed from Agassiz Station 395
K. R. Ramaprasad, John Caldwell, and D. S. McClure. The Vibrational Overtone Spectrum of Liquid Methane in the Visible and Near Infrared: Applications to Planetary Studies 400
Bjarne S. Haugstad. Turbulence in Planetary Occultations. II. Effects on Atmospheric Profiles Derived from Doppler Measurements 410
Bjarne S. Haugstad. Turbulence in Planetary Occultations. III. Effects on Atmospheric Profiles Derived from Intensity Measurements 422
George W. Kattawar and Charles N. Adams. Radiative Transfer in Spherical Shell Atmospheres. II. Asymmetric Phase Functions 436

Notes

Verne R. Oberbeck. The Expected Frequency of Doublet Craters (A Reply) 450
Alexander Woronow. A Reply to V. R. Oberbeck's Criticisms of "The Expected Frequency of Doublet Craters" 452

EPLY TO BOOK REVIEW

E. J. ÖPIK. A Reply to Richard Greenberg's Review of *Interplanetary Encounters: Close Range Gravitational Interactions* 454
UTHOR INDEX FOR VOLUME 35 455

he Subject Index for Volume 35 will appear in the December 1978 issue as part of a cumulative index for the year 1978.

Digitized by the Internet Archive
in 2026

https://archive.org/details/icarus_1978_35_contents

INFORMATION FOR AUTHORS

ICARUS is devoted to the publication of original contributions in the field of solar system studies. Manuscripts reporting the results of new research—observational, experimental, or theoretical—concerning the astronomy, geology, meteorology, physics, chemistry, biology, and other scientific aspects of the solar or extrasolar systems are welcome. The journal generally does not publish papers devoted *exclusively* to the Sun, the Earth, celestial mechanics, or astrophysics. The preferred language of publication is English, but in special cases manuscripts are considered in French, German, or Russian. All papers are reviewed, generally by two independent referees. Authors may be asked to respond to criticisms and suggestions by the referees prior to publication.

Manuscripts are accepted for review with the understanding that the same work has not been and will not be published nor is presently submitted elsewhere, and that all persons listed as authors have given their approval for the submission of the paper; further, that any person cited as a source of personal communications has approved such citation. Written authorization may be required at the Editor's discretion. Articles and any other material published in *Icarus* represent the opinions of the author(s) and should not be construed to reflect the opinions of the Editor(s) and the Publisher.

Authors submitting a manuscript do so on the understanding that if it is accepted for publication, copyright in the article, including the right to reproduce the article in all forms and media, shall be assigned exclusively to the Publisher. The Publisher will not refuse any reasonable request by the author for permission to reproduce any of his or her contributions to the journal.

There are no page charges.

Manuscripts. Authors should submit **four copies** of the manuscript, including figures, tables, etc., to the Editor, and should retain the original typescript. One of the four sets of figures should be suitable for camera-ready reproduction. All manuscripts must be typewritten with wide margins and **double-spaced throughout,** including references and footnotes. Number each page of the manuscript. Include on the first page the title, name(s) and affiliation(s) of author(s) including mailing address(es). At the bottom of this page note the number of manuscript pages, figures, and tables. On the second page indicate a proposed running head of not more than 35 characters, and the name and address to which editorial correspondence and proofs should be directed. The third page should contain a brief abstract, and the text should begin on the following page. Following the main text, give Appendices, Acknowledgments, References, Tables, Figure Captions, and Figures, in that order. Places where Figures and Tables are to appear in the published paper should be marked in the margins of the manuscript.

Tables are to be numbered consecutively with Roman numerals in order of their citation in the text. Each table should be typed, **double-spaced,** on a separate sheet with due regard to the proportions of the printed page. All tables should bear appropriate headings.

Figures. At the time of submission of the manuscript, one original of each figure is to be submitted in such form as to permit photographic reproduction without redrawing: Line drawings should be carefully drafted, no larger than 22 × 30 cm. Both original drawings or standard glossy photographic reproductions are acceptable. The lettering should be large enough to allow a reduction to $\frac{1}{3}$ the original size. **Each figure should be identified with the author's name and figure number.** All figures, whether line drawings or half-tones, should be numbered consecutively in Arabic numerals, in order of their citation in the text. Figure captions should be typewritten on a separate sheet, following the text. Color plates and foldouts are published at the author's expense.

Literature citations in the text should be in one of the following forms: Leighton and Murray, 1966 (for two authors); Marov *et al.*, 1973 (for three or more authors); Robertson, 1937, p. 436 (for reference to a specific page). To distinguish two or more works by the same author(s) in the same year, use suffixes a, b, etc., following the year (e.g., Öpik, 1966a, 1966b).

Literature citations in the bibliography should be **listed alphabetically** according to the surname of the (first) author. Journal references should contain the **names and initials of all authors, the year, the title of the article, the standard abbreviation of the journal, the volume number, and the first and last page numbers.** Titles of journals and books should be in italics, volume numbers in bold face. (In a typed manuscript, indicate italics by single underlining and bold face by sawtooth or double underlining.) Below are shown examples of the proper reference forms for a journal article, a book chapter, and a book, respectively.

Goldreich, P., and Peale, S. J. (1968). The dynamics of planetary rotations. *Ann. Rev. Astron. Astrophys.* **6**, 287–320.

Harris, D. L. (1961). Photometry and colorimetry of planets and satellites. In *Planets and Satellites* (G. P. Kuiper and B. M. Middlehurst, Eds.), pp. 272–342. University of Chicago Press, Chicago.

Krinov, E. L. (1960). *Principles of Meteoritics.* Pergamon Press, New York.

Careful compliance with these instructions for the preparation of the list of references is required; manuscripts with incomplete references (or missing abstracts) may be returned to the author for correction before being considered for publication.

Please write with attention to organization, style, and especially brevity. Present results logically, with order dictated by the needs of the reader. Take special care in composing the title and abstract, since these will be the most frequently read sections of the paper. In the title, specific words are preferable to general ones. The abstract should summarize the conclusions of the research, including quantitative results where appropriate, rather than merely stating the problem.

Whenever possible, quotients in mathematical expressions should employ the solidus (/) rather than be displayed in built-up form. However, for units, exponential notation is preferred (e.g., erg cm^{-2} s^{-1}, not erg/cm^2s). Most authors will recall the difference between "i.e.," and "e.g.", will note that such nouns as "data" are plural and "mare" singular, and will take care to insert a zero before decimal fractions lying between $+1$ and -1.

Galley proofs will be furnished to authors. When submitting a manuscript, the author should include a list of the symbols employed, identified typographically, not mathematically. This list will not be printed, but will help to avoid costly author's corrections in proof. Fifty *reprints* of each paper will be furnished gratis to the author and additional reprints may be purchased.